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# Intervehicle Crash Preventing Enhancement System

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**ABSTRACT:** Among most of the existing sensor systemsuses radar and laser technologies for automotive adaptive cruise control and collision avoidance. These systems will work only if the intervehicle gap is greater than 1 m. The main theme of this paper is to convey technologies to predict collision among vehicles and smart activation of safety systems like air bag deployment, seat belt tightening. In order to work under small intervehicle spacing Anisotropic Magneto-Resistive (AMR) and sonar/ultrasonic sensors are used. In automotive industry, research on a system which can estimate the beforehand inevitable collision has anabundant impact and the sensors arrangementmostly relies on the relative velocity measurement of the vehicles.The relative position of vehicles are obtained by using Anisotropic Magneto-Resistive. A playback is used to caution the vehicle after measuring the distances from the sensors.

**KEYWORDS**: Crash prediction, ultrasonic sensor,Anisotropic Magneto-Resistivesensor, playback.

## I.INTRODUCTION

The first motion sensor which is invented by Samuel Bagno is implanted in an alarm system came about in the early part of 1950's.this device made use of ultrasonic frequencies and Doppler Effect.In 1826 Jean Daniel Colladon discovered sonography using an underwater bell resulting in determining the speed of sound in water accurately. Thereafter, the study and research work in this field went on slowly until 1881 when Pierre Curie's discovery set the stage for modern ultrasound transducers. Sonar sensors are used during short initial time duration leads to a reliable estimator since they don't work at very small intervehicle space and have low refresh rates. Ultrasonic sensors use electrical–mechanical energy transformation to measure distance from sensor to target object. Ultrasonic sensors have many useslike in parking assistance sensors in cars, proximity alarms, medical ultrasounds, generic distance measurement and commercial fish finders.The efficient working of ultrasonic sensors is when they are placed in front of materials that instantly reflect

ultrasonic waves such as metal, plastic and glass which enables the sensor to give an accurate reading at a larger distance from the object.The sensor must move closer to the targetthat instantaneously absorbs ultrasonic waves such as fiber material to give an accurate reading.

Sir William Herschel discovered infrared sensor as a form of radiation beyond red light.Infrared rays has a great application for thermal measurement.To estimate the magnetic field and to obtainrelative position of vehicles AMR sensors are used.Infrared sensor is used to measure the distance which is very near to the vehicle. This technique is used in intrusion detection, object detection, barcode decoding, and surface feature detection (detecting features painted, taped, or otherwise marked onto the floor), wall tracking (sensing distance from the wall) etc.

The ordinary magneto resistance was discovered by William Thomson (Lord Kevin) in 1856. He discovered that the resistance increases when the current is in the same direction as the magnetic force and decreases when the current is at 90°to the magnetic force bye experimenting with pieces of iron.An AMR sensor is utilized to detect the disturbance in the earths' magnetic field triggered by the vehicle during its travel over/alongside the sensor. The detected signal's shape depends on the size of the vehicle such as car, bus, truck etc. A vehicle is made of many metallic parts (for example, chassis, engine, body, etc.), which have a residual magnetic field or gets magnetized in the magnetic field of earth. These magnetic fields create a net magnetic field for the whole vehicle, which could be analytically modeled as a

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function of vehicle-specific parameters and position around the vehicle. The magnetic field disturbances caused by a vehicle is enough to be identified by a magnetic sensor. This property of AMR sensor creates it a prospective candidate for vehicle detection, traffic surveillance, parking lot management, automatic toll collection, and law enforcement.
The British computer manufacturer Acorn Computers first developed the ARM in 1980's.Coprocessor modules for the BBC Micro series of computers were its first ARM based products. After the successful BBC Microcomputer Acorn Computers considered to move on from the relatively simple MOS technology 6502 processor to address business markets. ARM is a family of instruction set architectures for computer processors developed by British company ARM Holdings, established on a reduced instruction set computing (RISC) architecture. ARM7 is one of the micro-controller family in embedded system application which is vastly used. George H. Heilmeier invented the LCD in 1964.Liquid Crystal Display with its compactness and versatility reformed the modern display technology. Today it is seen implanted in various electronic gadgets and devices like T.V, Computers, Laptops, Watches, etc. The heart of the display is the liquid crystal coating which is inserted between two polarized glasses. LCD's are available in various shapes and sizes depending on the configurations. Joseph Henry invented the first electric buzzer or playback in 1831. The first electric motor was invented by Thomas Davenport with the intention of commercial use,which he patented in 1837.Moritz Jacobi built the world's first real electric motor in May 1834 in Konigsberg.

## II.METHODOLOGY

The steps involved in this work are shown in the below fig1. When the vehicle starts sensors and other devices in the car gets initialised. If the obstacle appears then the ultrasonic sensor is activated and measures the distance between the approaching vehicle and the host vehicle which is shown in an LCD in fig 5. If the distance measured is greater than the threshold distance(310 in fig 10) ultrasonic sensor gets triggered and slows down the host vehicle by avoiding collision. If the distance measured is less than the threshold distance shown in fig11, AMR sensor gets activated and makes the decision of direction with respect to the direction of the approaching vehicle.
If the direction of the approaching vehicle is left,then the left IR sensor of the host vehicle senses the object and triggers the right motor resulting the host vehicle to make a right turn. Ultrasonic sensor sensing the left object is shown in fig 6. If the direction of the approaching vehicle is right,then the right IR sensor of the host vehicle senses the object and triggers the left motor resulting the host vehicle to make a left turn. Ultrasonic sensor sensing the right object is shown in fig 7. If the approaching vehicle is coming from the back drection,then the back left IR and back right IR sensors detect the object and gives warnings through the playback resulting the host vehicle to stop by the function of motors. Ultrasonic sensor sensing the back left side object and back right side object are shown in fig 8 and fig 9.
For 1-D motion, the vehicle is moving straight towards or away from the sensors which can create an impact due to collision can occur at any location around the car body. At point B an IR sensor is positioned in the host vehicle at left side of the car and the ultrasonic sensor placed at the front of the approaching vehicle. The IR sensor detects the objects and computes the distance between the vehicles in both X- axis and Y-axis.
The approaching vehicle where the sensor is set in front also estimates the distance of the vehicle in two dimensional. where r is the distance measured alongside the direction of motion. However, if $\theta$ is not constant or if the colliding vehicle is moving towards the sensors at an offset (meaning that its center line does not pass through the center of the IR sensor), the preceding approach cannot be adopted.
Hence, to fully identify and classify a crash in 2-D motion, we need to estimate xB , yB , v, $\theta$, and $\omega$, as shown in Fig 1, where xB and yB are the position of point B with respect to the coordinate frame attached to the approaching car, v is the longitudinal velocity of the approaching car along its x-axis, $\theta$ is the orientation of the approaching car relative to the host car (in other words, it is the anglebetween the x-axis of the coor- dinate frame attached to the approaching car and the X -axis of the coordinate frame at point B), and $\omega$ is the rotational velocity of the approaching car.

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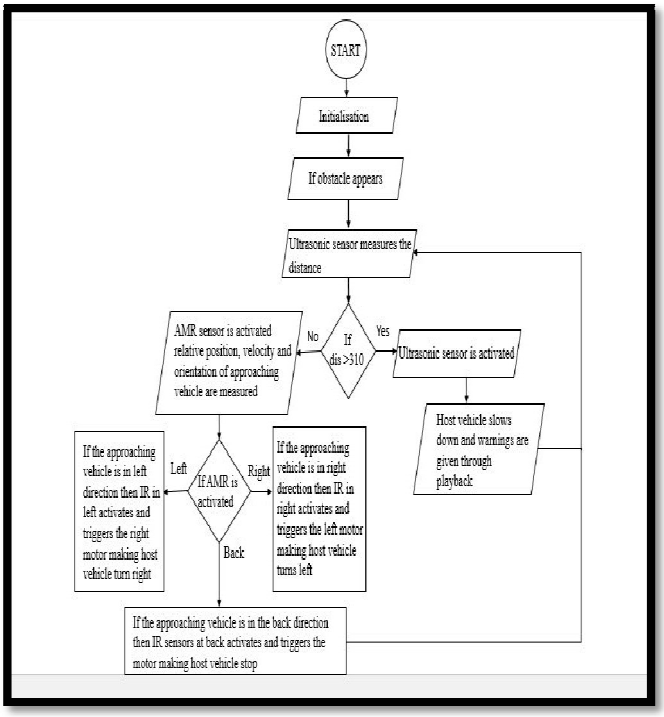


Fig1: Flowchart

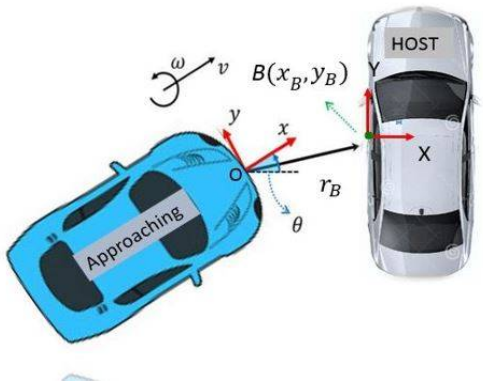


Fig 2:Two-dimensional position estimation and the parameters to be estimated.

## III.PROPOSED SYSTEM

A low-cost sensor system should be developed which can foretell the collision. Block diagram displays the sensors used which are attached to the microcontroller where the operation is done.The vehicle is sensed via sonar sensors in right, left and back direction and AMR sensor in the front direction.The ARM controller acts according to the output given by the sensors. The warning sounds are given out loud by playback to terminate the collision. If the probability of collision occurring is high then the motors halt the vehicle hence preventing from collision to happen. The IR and sonar sensors are used to detect objects from large distances which makes them unreliable yet supportive for this project.

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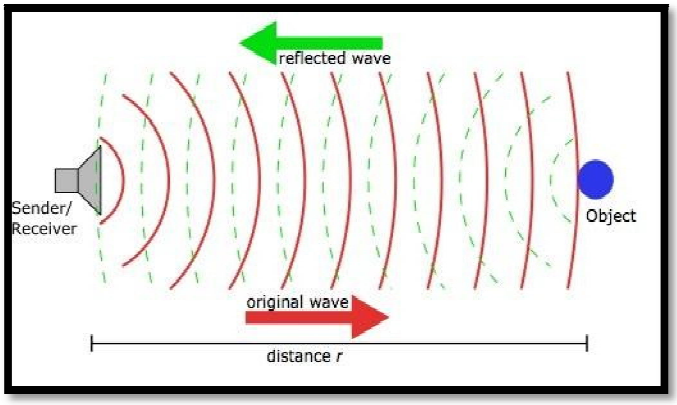


Fig3: Ultrasonic sensor

Ultrasonic sensor uses the speed at which sound waves travel to measure distance to an object. The sensor has two openings, one radiates ultrasonic waves, while the other captivates them.Ultrasonicc sensor measures distance by the time taken how for an ultrasonic wavee directed out by the emitter to bounce off an object and comes back to the receiver. It can be estimated using the following equation,

**Distance of the object= T × Speed of Sound**
**2**

Where T= time between when an ultrasonic wave is emitted and when it is received. Division by 2 is because the sound wave has to travel to the object and back.

AMR sensors are used for less distances which makes the device efficient in predicting collision.ARM “Processor Architecture” which stands for “Acorn RISC Machine” based on a reduced instruction set computing (RISC) architecture.L293D is a typical Motor Driver IC which allows DC motor to drive on both directions. L293D is a 16-pin IC which controls two DC motors concurrently in any direction. Two DC motors are controlled by a single L293D IC.The distance between the host vehicle and other vehicles that are in vicinity is displayed in LCD(Liquid Crystal Display).The magnetic field from another vehicle in close proximity,relative position, velocity, and orientation of the vehicle are estimated by using AMR sensors.

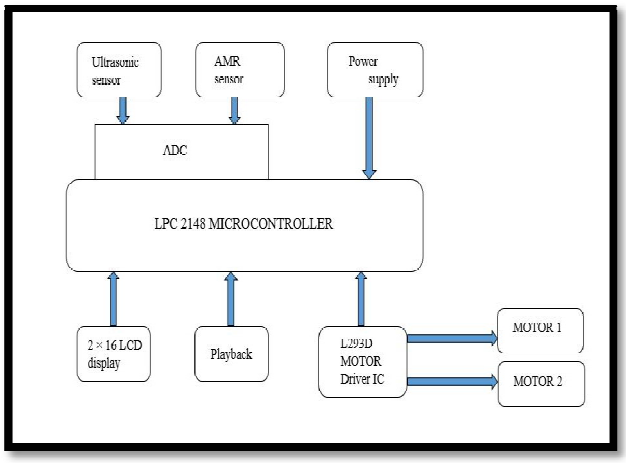


Fig4:Block Diagram

## IV.RESULT

The output from the sensors are given to the microcontroller and the left side,right side and back side detected objects are displayed in the LCD by using IR sensors and front objects are sensed using AMR sensor which provides the

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distances. A playback is used where warnings areheard based on the results from the sensor which are recorded manually in order to caution or notify to the driver in the vehicle.When a collision may happen where the vehicle is close to the host vehicle the motors in the host vehicle will stop.


Fig 5: LCD display of sensors reading

In figure 5 the LCD display shows that the "L" indicates the left IR ,"R" indicates right IR sensor,"B1" indicates back left IR sensor,"B2" indicates back right IR sensor. "DIS" (distance) indicates the ultrasonic sensor reading.

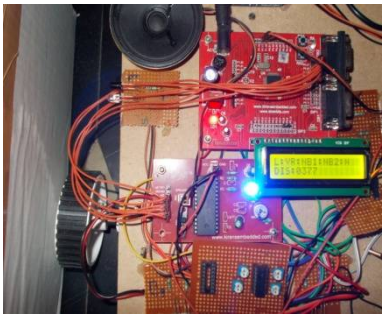

Fig 6: LCD display shows left side object detected by IR sensor

In figure 6 LCD display shows that the IR sensor detects the object/ vehicle which is present in front of the left IR sensor so that it displays L: Y and remaining N and also the distance measured by the ultrasonic sensor indicates its distance in the display.

For 1-D motion, the vehicle is moving straight towards or away from the sensors which can create an impact due to collision can occur at any location around the car body. At point B an IR sensor is positioned in the host vehicle at left side of the car and the ultrasonic sensor placed at the front of the approaching vehicle. The IR sensor detects the objects and computes the distance between the vehicles in both X- axis and Y-axis.

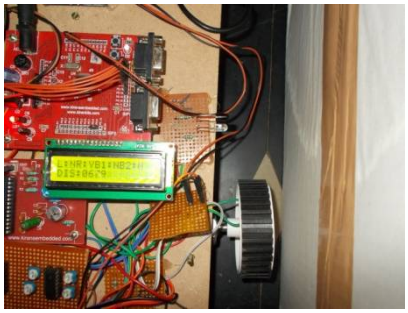

Fig 7: LCD display shows right side object detected by IR Sensor.

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In figure 7 the LCD display shows that R:Y mean that there is an obstacle or a vehicle in front of the right IR sensor /right side of a vehicle. It detects the obstacle and displays it on the LCD display.

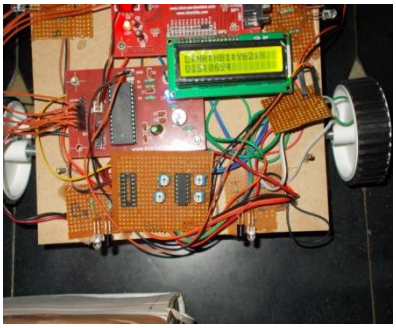

Fig 8: LCD display shows back left side object detected by IR sensor

In figure 8 the back left IR sensor which detects the vehicle/ obstacle and displays it as B1: Y which means that there is a vehicle at the back left of the vehicle and warns the driver through the playback.

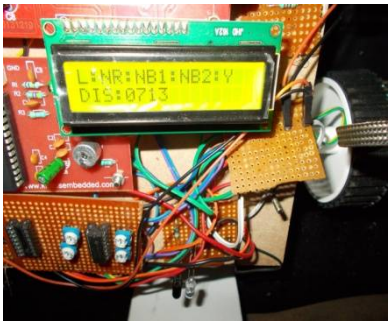


Fig 9: LCD display shows back right side object detected by IR sensor

In figure 9 the back right IR sensor detects the vehicle and displays it as B2: Y which means that at the back of the vehicle right side there is a vehicle detected and this is displayed on the LCD and warns the driver to through the playback.


Fig 10: LCD display shows distance measured by the ultrasonic sensor

In the figure 10 the LCD display shows that DIS is less than 310 means the vehicle in front of the host vehicle is very near at that time the ultrasonic sensor detects the vehicle and take turn and displays its measure.

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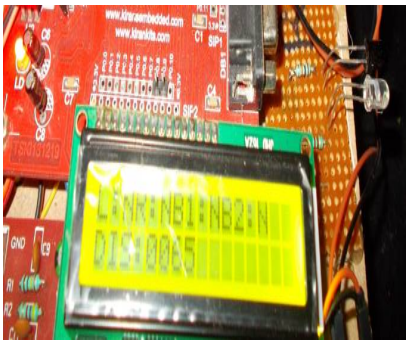

Fig 11: LCD display shows distance measuredby the ultrasonic sensor is less than the reference distance.

This figure 11 shows that if the vehicle is very near to the host vehicle then the ultrasonic sensor will detect it and displays in the LCD and stops the vehicle when the opposite vehicle is in very close proximity to the host vehicle.

## V.CONCLUSION

This paper is dedicated to the improvement of a unique sensor system with AMR and sonar sensors for the measurement of relative position and orientation of another vehicle in nearbyarea. Use of combined sensors in this project results in a reliable system that performs well without the knowledge of vehicle- specific magnetic field parameters. The tentative results in this paper confirm that the developed sensor system is sustainable and that it is feasible to adaptively estimate vehicle position and orientation even without knowledge of vehicle- dependent parameters.

## REFRENCES

[1] J. G. Buechele and G. A. Cazzell, "Automotive bumper active energy absorption system," U.S. Patent 6 836 717, Dec. 28, 2004.
[2] D. Lee, Z. Ma, and N. Kikuchi, "An innovative I-bumper concept for improved crashworthiness of military and commercial vehicles," presented at the SAE World Congr. Exhib. Detroit, MI, USA, 2008, SAE Tech. Paper 2008-01- 0512.
[3] M. J. Caruso and L. S. Withanawasam, "Vehicle detection and compass applications using AMR magnetic sensors," in Proc. Sensors Expo, 1999, pp. 477–489.
[4] S. Taghvaeeyan and R. Rajamani, "Use of vehicle magnetic signatures for position estimation," Appl. Phys. Lett., vol. 99, no. 13, pp. 134101-1–134101-3, Sep. 2011.
[5] S. Taghvaeeyan and R. Rajamani, "Two-dimensional sensor system for automotive crash prediction," in Proc. ASME DSCC, Fort Lauderdale, FL, USA, 2012, pp. 681–688.
[6] Y. Bar-Shalom, Estimation with Applications to Tracking and Navigation. Hoboken, NJ, USA: Wiley, 2001.
[7] R. Mobus and U. Kolbe, "Multi-target multi-object tracking, sensor fusion of radar and infrared," in Proc. IEEE Intell. Veh. Symp., 2004, pp. 732–737.
[8] S. Matzka and R. Altendorfer, "A comparison of track- to-track fusion algorithms for automotive sensor fusion," in Proc. IEEE Int. Conf. MFIIntell. Syst., 2008, pp. 189–194.
[9] G. R. Widmann, M. Daniels, L. Hamilton, L. Humm, B. Riley, J. K. Schiffmann, D. E. Schnelker, and W. H. Wishon, "Comparison of lidar-based and radar-based adaptive cruise control systems," presented at the SAE World Congr., Detroit, MI, USA, 2000, 2000-01-0345.
[10] I. Moon, K. Yi, D. Caveney, and J. K. Hedrick (2005, Sep.). A multi-target tracking algorithm for application to adaptive cruise control. J. Mech. Sci.